

INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

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SUBJECT Polish Telecommunications
Institutes and Installations

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Polish research institutes and installations

Institute of Telecommunications
Institute of Engineering and Radio Engineering
Television Receiver Laboratory
Laboratory for Mobile Installations
Laboratory for Civilian (radio) receivers

- Radio Engineering Group

Dielectric and Piezoelectric Materials
Laboratory for Quartz Oscillators
Laboratory for Magnetic Materials
Laboratory for Metallization
Laboratory for Heat Treatment
Laboratory for Synthetic Resins

- Technological Group for
Materials & Components

Measurement Group.

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13 March 1957

SUBJECT: POLAND - Polish Research Institutes and Installations

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I TELECOMMUNICATIONS INSTITUTE

Generalities

At the present time, the Institute is divided into seven individual Offices.

There are about 300 technicians and 50 administrative employees under the direction of Engineer RZYMKOSKI.

The Institute is subordinate to the Ministry of Telecommunications. However, 5 years ago one part was detached and placed under the Ministry of Industry although it still keeps its place in the Institute. This part has taken the name of "INSTITUTE OF TELEGRAPHY AND RADIO ENGINEERING"

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The individual sectors of the Institute, at present scattered among the various Offices, will be brought together next year in a single office situated about 20 kilometers from the center of WARSAW.

This is in a wooded area far from the inhabited zone but with easy transportation. The standards are modern and very similar to those used in the USA.

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The building is C-shaped, rather low and rambling, and is nearing completion.

Independent auxiliary buildings house the central heating plant, the transformer station, and the cultural, recreational Club.

Housing for the personnel - one-family homes or units with several apartments - is being erected close to the Institute's buildings.

Each building is set in a lot measuring about 800 square meters.

It is planned that the Institute and the services will have 800 people.

The arrangement of the rooms is quite simple because they open on two sides of long corridors.

The dimensions are unified, starting with a standard room of about 3 by 4 meters and the larger rooms are multiples of this.

Following modern thoughts, centralization has been reduced to the barest necessities.

Each room is supplied only with 220-380-volt alternating current; a group of batteries is planned only for the Telegraphic Laboratory.

Gas, when needed, will be supplied by tanks.

In the old office, the following are some of the work sectors:

a. MEASURE OF THE BAND WIDTH OF THE TELEGRAPH SYSTEMS

The measurement is carried out according to the recommendations

of the CCIR. The width of the band is considered the part in which 99 percent of the power is contained.

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Measurements can now be made for band widths to 5.4 kilocycles and it is planned to extend them to 30 kilocycles.

b. LINE REPEATERS WITH NEGATIVE IMPEDANCE

These are quite similar to the BELL repeater in structure but with some changes in construction.

The gain is 10-15 decibels and they are used on district lines. The units are plugged in by pins and in the event of the failure of the amplifier tube, a relay shortcircuits the intake and the outlet and assures continuation of service.

The displayed units are of series type, but a parallel series type is being built and this will permit a better coefficient of reflection and consequently to connecting of more units than is possible at present.

c. MOBILE EQUIPMENT

A receiver-transmitter with frequency modulation with a narrow band in the 32-48 microcycle range has been built.

The transmitter is the conventional type, crystal control, and with an amplifying factor of 18.

The variation from the set frequency is plus or minus 15 kilocycles.

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The receiver is the usual type with double ^{frequency} conversion with limiter and discriminator. The strength of the radio-frequency output is about 15 watts. The tubes are of the PHILIPS type.

A receiver-transmitter for mines has also been built. This uses the standard circuit and works at about 100 kilocycles.

The antenna is a spiral with a diameter of about 70 centimeters and is connected to any type of conductors which are in the mine. The range depends upon the structure of the electrical installation, and the geological and topographical formations. The average range is about 1.5 kilometers. The apparatus is portable, operates on dry batteries, and uses miniature ignition tubes ^[sic]; ad accensione 1.4 of American type.

d. CHECKING BROADCASTS

The daily plotting of the broadcast frequency of all stations of Poland is made by comparing this frequency to a standard frequency, accurate to 10^{-7} , supplied by another office by wire. Weekly, measurements are made almost simultaneously with the analogous Czechoslovak office in order to make a comparison.

Various measurements of the quality of the broadcast and the intensity of radiation are also made. There are plans for a series of measurements of the suitability of the ground. It is expected that the method to be followed will be the indirect method based on measuring the electromagnetic field close to the ground itself.

e. EQUIPMENT FOR FREQUENCY COMPARISON

In theory, the operation of the equipment is quite simple but in practice quite complex.

The method of measuring is by using an oscillograph. The signal of unknown frequency is sent to the vertical axis. The frequency voltages are registered on the two plates of horizontal deflecting electrodes. The deviation from the standard frequency varies respectively by 100 cycles and by 5 cycles.

The accuracy of the luminosity is one one-hundredth of a cycle.

f. ELECTRONIC METER

This is an electronic meter with six 10-step units, working with links of division with semi-stable multivibrator, suitable for measuring frequencies up to 2.2 megacycles.

The structure is conventional but rather cumbersome because of the normal size tubes which are used.

It is planned to extend the frequency field up to 12 megacycles, using for the first stages multiplier Philips tubes with secondary emission.

A further extension of the frequency field is also planned toward high (frequencies), using the well-known system of harmonics.

For problems of general frequency division, the laboratory has already used "dekatron"-type discharge tubes. However, the tubes which have been observed seem to be Philips tubes of the EIT type.

g. MICROWAVE OSCILLATORS

An experimental model of a double-cavity oscillator with "faro" tube for a frequency of 2,000 megacycles has been prepared.

The discharge power is 50 watts with pulse rate of one second and a duty cycle of one to 20.

The structure is conventional and clearly follows American engineering. Apparently, no experiments with progressive-wave tubes have yet been made.

H. TELEVISION

At present, there is a limited television broadcast service in POLAND, with two transmitters: one at WARSAW and the other at LODZ. The standardization is, as noted, Russian.

The Institute considers the work of starting blank and white TV service as completed and therefore in the future will dedicate its work ~~to~~ essentially to color broadcasts.

At present there are two questions still unanswered: that of making receivers with a collective antenna; and that of testing receivers of Polish make which, it seems, may appear on the market very soon. There are some Polish prototype receivers with 12-inch circular picture tubes.

i. STUDIO FOR TV TRANSMISSIONS

The Institute has a small studio, about 10 by 7 meters, which was used until very recently for all television transmissions.

At present, it is used for the transmission of films by iconoscope.

The setting up of a control frame is in progress;

1. AMPLIFIER FOR WIRE-CARRIED BROADCASTS

An amplifier for the transmission of programs over wires has recently been built. The output is 4 kilowatts with 20 cycle - 20 kilocycle tuning.

The expected distortion is one percent, but at present is around 2 percent.

It is of conventional construction with four power tubes with internal anode, quite similar in appearance to the well known Philips type.

The most frequently used amplifiers are of smaller power, 2 kilowatts, or even more frequently 0.6 kilowatts.

These amplifiers are used in rural type groupings with up to 20,000 inhabitants. Each user is supplied with a power of at least 0.5 watts.

GENERAL OBSERVATIONS

Up to now, it seems that the Institute has been dedicated to the construction of prototypes for industrial application rather than to true and proper research.

The equipment and the instruments apparently come from diverse origins

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The library consists of a single room of about 40 square meters with open shelves either along the sides or in the center.

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The magazines, mostly from the East, also include the "Review of the Posts and Telecommunications." "High Frequency" and "Small Notes, Reviews, and Notices" were also observed. The collections of magazines are quite recent and mostly of Eastern origin.

In general, there is a desire for better relations with the West ~~both~~ with respect to books and publications and to material or apparatus of scientific interest.

II INSTITUTE OF ENGINEERING AND RADIO ENGINEERING

This Institute is housed in a building adjacent to that of the Institute of Telecommunications, previously mentioned.

Generalities

The Institute dates back to 1930; during the war the building was not damaged but the installations were all removed and the activity was totally disrupted until 1944.

From 1944 to 1948 the Institute regained its pre-war level and, in 1951, it separated from the Institute of Telecommunications.

At the end of 1955, the "MICRO-WAVE" section separated from it and this was the origin of a new Institute with headquarters in another part of WARSAW.

The Institute is directly subordinate to the Ministry of Industry and is directly interested in problems of radio engineering and also applied electronics and, among other things, supplies

industry with prototypes of new apparatus.

The Institute employs about 500 persons, of which engineers account for a third. The figure doesnot include administrative officers and office personnel.

The Institute is divided into three principal branches: (1) wire communications, (2) radio communications, and (3) technology of materials and of the components.

Each branch has five divisions and each of these, in turn, has three or four laboratories.

The Institute has a shop attached to it which is capable of producing prototypes or limited numbers of apparatus for which special equipment is not needed.

The work may be originated by the State, by the requests of industry, or by its own initiative. Up to the present, the main work has been advancing industrial productions.

The teachers of the Polytechnic collaborate with the Institute either as permanent members or on a consultant basis.

MAIN LABORATORIES

A RADIO ENGINEERING GROUP

1 TELEVISION RECEIVER SETS LABORATORY

Tests of the first series of Polish-built television receiving sets with a 14-inch circular cinescope are now being conducted.

The usually checking is being done and the checking instruments used are mostly of domestic construction. A "OBBULATOR" of ferrite is one of these instruments.

Next year the laboratory will begin to work on color television.

2. LABORATORY FOR MOBILE INSTALLATIONS

A transmitter-receiver for double purpose has been constructed which is to be installed in a vehicle.

The working frequency is between 67 and 87 megacycles.

The transmitting circuit is the conventional type with crystal control, frequency multiplier for 36 or 27, frequency modulation with a maximum drift of plus or minus 15 kilocycles, and frequency modulation from 300 to 3,000 cycles.

The output is about 20 watts.

In order to reduce the number of tubes of the transmitter, a modulator circuit with germanium diodes is under study.



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A transmitter is also planned with almost double power through grounding.

The receiver is the superheterodyne type with double frequency conversion of 15 megacycles and 1.7 megacycles.

The sensitivity for normalized output is 2 volts; the final amplifier stage of low frequency can supply up to 2 watts.

3. LABORATORY FOR CIVILIAN USE

This laboratory tests the new receivers for amplitude modulation and frequency modulation of the [radio] industry and develops new plans.

A table model AM-FM receiver with four bands (190-550 meters in two bands; 1,100-2,000 meters; 88-100 megacycles), two loudspeakers, and a three-speed record player has been shown.

The set is based on European engineering, and is sold for about 2,000 zloti.

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Various circuits for FM radio receivers are under study and testing. Generally, it is a question of reproducing or adopting solutions already used in the Western nations.

Apparently there are two FM transmitting stations in WARSAW.

B. TECHNOLOGICAL GROUP FOR MATERIALS AND COMPONENTS

1. DIELECTRIC AND PIEZOELECTRIC MATERIALS

The most important production is that of quartz crystals produced artificially in an autoclave at a pressure of 1,000 atmospheres.

The autoclave consists of a steel cylinder with a diameter of about 40 millimeters and a thickness of ~~20~~ 20 millimeters. The length is about 400 millimeters and the two ends are closed by threaded caps.

On the inside, a stainless steel support holds three seeds around which the crystallization takes place. The solution is supplied from a deposit of material placed on the bottom.

The autoclave is heated from below by a resistance plate so that the temperature varies from bottom upwards from 400 to 380 degrees Centigrade.

The extreme temperatures are controlled by thermocoupleings. The growth of the crystal is about 0.5 millimeters a day and the production of a complete crystal requires from 2 to 3 weeks.

During this period there is no possibility of controlling the crystallization (qs) that sometimes the final crystal is defective and unusable.

This same laboratory also produces ceramic material of the titanate type for use in condensers, or in transducers for supersonants, or in pickups.

In production, a temperature control of plus or minus 10 degrees Centigrade is considered sufficient.

Finally, crystals of Seignette salts, of lithium sulfate, and of other analogous salts for electro-acoustic uses are produced.

2. LABORATORY FOR QUARTZ OSCILLATORS

This laboratory cuts and ~~assembles~~ assembles the quartz specimens, starting with artificially produced material.

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An extensive series of types with a frequency range from 4 kilocycles to 15 megacycles is constructed.

For crystals to be used in medium-wave transmitters, the accuracy of calibration is plus or minus one cycle.

The laboratory is equipped ^{with} numerous test devices of domestic construction.

3. LABORATORY FOR MAGNETIC MATERIALS

Almost all ordinary magnetic tests on plates are made.

It has been confirmed that the plates normally used are 0.35 millimeters thick and the loss is 1.3 watts per kilogram.

Ferrites suitable for the construction of cores for radio frequency have been made. This procedure has now been industrialized.

Studies for the production of hard steels have been started and some samples are now available.

The most notable piece of equipment is a ZEISS metallurgical microscope.

4. LABORATORY FOR METALLIZATION

Metallizations for various purposes are done, especially with silver and aluminum at pressures of about 10^{-4} millimeters of mercury.

It is planned to study metallization with alloys for the manufacture of resistors.

This laboratory produces also resistors of the "BOROCARBON" type.

5. LABORATORY FOR HEAT TREATMENT

Heat treatments for special magnetic materials, such as permalloy, are done here.

The laboratory is equipped with two hydrogen furnaces.

6. LABORATORY FOR SYNTHETIC RESINS

This laboratory has just started its activities.

The Laboratory has now produced resistance elements for normal potentiometers and for use in components for high frequency.

It is also studying protective materials for resistors and a group of synthetic resins of the "araldite" type.

C MEASUREMENT GROUP

The principal equipment is: a meter for amplitude of vibrations and devices for measuring the noise of the resistors.

Measurement is made throughout the 15-5,000 cycle range by comparison with a sinusoidal signal. The results of the measurement are not yet available.

1. EQUIPMENT FOR MEASURING THE NOISE OF THE ELECTRONIC RECEIVER TUBES

The apparatus is quite large and has the normal structure of inspection benches.

Great care is taken with the input which is set at 3×10^{-5} and with the shielding.

The noise is measured on four channels (30 cycles, 100 cycles, 465 kilocycles, and 5 megacycles) by comparison with noise diode.

2. VOLTMETER FOR MEASUREMENTS OF VOLTAGE

The apparatus measures voltages from one volt to one [sic] volt for frequencies from 0.1 to 100 megacycles.

3. FREQUENCY STANDARD

It is stated that the accuracy is plus or minus 10^{-8} .

Apparently no comparisons have been made with standards of

Western nations but only with analogous standards at WARSAW.

The apparatus still has an experimental look and the room in which it is kept is not temperature-controlled.

4. INSTRUMENT CHECKING ROOM

The necessary checking of the instruments of the other laboratories is done here.

III TELEVISION INSTALLATIONS

A television network is now appearing in POLAND, with two broadcasting stations: one in WARSAW and the other in LODZ.

The physical layout of the WARSAW installation is:

Transmitting antenna, attached to the top of the pinnacle over the Palace of Culture and Science, at 240 meters above ground level.

Transmitter, on the 27th floor of the Palace, at 120 meters above ground level.

One group of studios on the fifth floor of the Palace.

Permanent connections through a coaxial cable between the preceding studios and the various theaters and sport areas of the Palace.

A second group of studios adjacent to the WARSAW HOTEL and connected with the first group by coaxial cable about 800 meters long.

A radio-television bridge between the 27th floor of the Palace and the Institute of Telecommunications.

The antenna is the turnstile type with a single element.

It is necessary to limit the elements to one, because a greater number would cause excessive mechanical stress on the pinnacle, which was not originally designed for this use.

The antenna is connected to the transmitter by a coaxial cable over 100 meters in length and with an outside diameter of about 10 centimeters.

The transmitter, Russian-built, operates on Channel 2 (according to the standard of the Eastern Nations) which has the following characteristics: a video carrier of 59.25 megacycles and an audio carrier of 65.75 megacycles.

The output of the video transmitter is 5 kilowatts; the output of the FM audio transmitter is 2.5 kilowatts.

If needed, the output of the video transmitter can be raised up to 7.5 kilowatts.

The video transmitter is of conventional construction with push-pull in the preliminary and final stages and with a side band eliminator.

All tubes are of Russian make; the cooling of the final stage is done with distilled water in a closed circuit. When the temperature of the discharged water goes over 50 degrees Centigrade, there is a first auditory alarm signal.

The construction method of the power tubes shows some interesting details and differs from the European and American method.

One of the things noted is the metal-glass joint done directly

on the tube envelope, with a conical contact surface, evidently with the aid of radio frequency. This method is used for diameters up to 10 centimeters.

Other details of internal construction are shown in the discarded tubes.

The mountings of the sockets differ from our method.

The "829 B" is made with internal reinforcement.

There is also a mercury-arc power rectifier with the internal electrodes very close and with very little mercury.

The audio transmitter uses a circuit which we have discarded for this type of installation. That is, the intermediate frequency modulation is controlled by a crystal oscillator through a discriminator, a low frequency filter, and an amplifier using direct current. The maximum frequency drift is plus or minus 75 kilocycles.

The two transmitters are housed in two sets of individual cabinets; a third group of cabinets is used for the input.

All equipment has greater dimensions than that customarily used in our installations and is grouped around a control panel. Consequently, there is very little space around the panel.

The ventilating system as well as the band eliminator, the DUPLXER, and the ~~MM~~ antenna line are more than adequate for the successive increased which are soon to be made in the power of the installation.

The control panel includes the usual picture monitor, the oscilloscopic indicators for synchronizing the line and the field, as well as the reflecting galvanometer.

A separate cabinet permits checking the power of the installation. This is done by the calorimetric method and the apparatus is connected to the coaxial cable which leads to the antenna through sectioning.

Preparation and the actual measuring require about 30 minutes.

There is also a ultrashort wave radio bridge receiving installation used to connect the transmitter with the mobile camera, soon to be ready.

At present the receiving installation is used only for connection with the Institute of Telecommunications, about 4 air-kilometers away.

The first group of studios included a hall for live shows, a room for the television cinema, a room for the video exchange, and other auxiliary rooms.

The hall has a television camera of Polish make using a Russian supericonoscope.

The orthicon will be used in the near future. Some tubes are now available but not the cameras.

The television cinema room has two projectors for diapositives.

An optic system connects all equipment with the shooting television camera, equipped with an iconoscope.

With the exception of the iconoscope, which is Russian, other equipment is mostly Polish.

The two projectors change over automatically at the end of the reel of film.

The video exchange receives all the coaxial cables from the theaters and sport areas of the Palace, the cable from the second group of studios, and the cable from the radio bridge receiver.

There are the usual distribution and mixing panels with the relative picture monitors and the small panel for a pair of synchronizing generators (one operating and on stand-by).

The synchronizing generators seem to be of simple construction and not very cumbersome.

Interchangeable parts are widely used. The assembly is accurate but the finishing touches apparently have not yet been made.

The tubes used are generally Russian but do not differ greatly from European. However, a diode rectifier, type 1 B 3, is worth noting. It is much shorter and has internal reinforcements.

Some of the numerous auxiliary rooms are used by the exchange for the audio portion and other are used as small maintenance laboratories.

The resolution with the monoscope does not seem to be over 400 lines. On the basis of this, it is thought that the final

adjustment of the installations may not yet be complete.

The second group of studios includes a small room for entertainments for limited audiences and a television cinema set.

The room is equipped with two television cameras of Polish make which have Russian supericonoscopes. A third television camera, analogous to the others, is used by the announcer.

The television cinema installation is very modern and has MARCONI-EMI flying spot equipment.

The ^{three} ~~three~~ cameras will soon be replaced by more modern cameras, also of MARCONI-EMI construction.

Television transmissions are still in the experimental stage and regular service is scheduled to begin on 1 January 1957.

At present, broadcasts are made five times a week, with a total of 25 hours of broadcasts, divided between the early afternoon and the evening.

The daytime broadcasts last for 3 hours and are transmission of the monoscope and an auditory signal. They are primarily for the use of the telecommunications industry.

The evening broadcasts last 2-3 hours and 50-60 percent are films.

Because of the nature of the service, a subscription charge has not yet been planned. Indeed, there is no idea what the charge will be.

The LODZ station broadcasts on Channel 3 (Eastern) at a power of 0.5 kilowatts for video and 0.25 kilowatts for audio.